A STUDY OF SAND SAMPLES FROM VAL BRILLIANT, QUEBEC

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by

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INTRODUCTION

In a letter dated September 24, 1982, Dr. R.A. Marleau, consultant to Uniquartz Inc. of Ile Bizard, Quebec, asked whether a study could be made at CANMET of processed sand samples from a sandstone deposit at Val Brilliant, Quebec. Dr. Marleau specifically requested the following test work.

Test A - The clean sand carries about 0.04% Fe_2O_3. We would like an acid (H_2SO_4) leach test in order to reduce the iron oxide to 0.02% (one test can be performed on a 25-pound sample, or as decided later).

Test B - Carry out a heavy minerals separation via heavy liquids on 3 samples of about one pound each. Only the 60-mesh fraction of each sample should be processed through heavy liquids (the heavy minerals in the fine fraction do not create any problems). The heavy minerals should be determined in weight per cent and mineral species should be identified petrographically. The heavy minerals concentrates obtained should be assayed for MnO, P_2O_5, V_2O_5, Cu, Cr, Co, Ni, with values expressed in ppm.

Test C - Determine the fusion point and the LOI on each of the three sand samples.

Mr. W.A. Gow, Director, Mineral Sciences Laboratories responded in a letter dated October 29, 1982, that this study could be done on a cost recovery basis for $2150.00. Estimated date of completing was December 15, 1982. This date was later extended to February 15, 1983, because of unavoidable delays.

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SAMPLE DESCRIPTIONS AND PREPARATION

Five samples were received as follows -

No. 1 - sand 1168 g
No. 2 - sand 1054 g
No. 3 - sand 629 g
No. 4 - sand 9806 g
No. 5 - sandstone

Representative, 100-g samples were cut from samples 1, 2 and 3 for reference and for fusion point determination; the remainder of each sample was then separately screened on a 60-mesh sieve. Sieve results were as follows -

Sample No.	+60 mesh (%)	-60 mesh (%)
1	68.5	31.5
2	42.5	57.5
3	57.5	42.5

The plus 60-mesh portions of samples 1 to 3 were retained for heavy liquid separation tests and for mineralogy and chemical analysis of sink fractions.

A representative, 200-g sample was cut from sample 4 for reference and sieve analysis. Results were as follows -

Mesh Sieve	Wt %
+ 28	2.7
- 28 + 35	19.6
- 35 + 48	27.2
- 48 + 65	19.3
- 65 + 100	18.9
-100 + 150	10.2
-150 + 200	2.1
-200	0.0
	100.0

The remainder of sample 4 was retained for acid leach studies.

An examination by binocular microscope of the various mesh fractions of sample 4 indicated that the sand was of high-purity but obviously over-crushed during its preparation from the original sandstone. The coarser sizes consisted of subrounded to subangular grains of free quartz with a substantial percentage of agglomerates or compound grains. The finer sizes were essentially free of compound grains but contained large percentages of sharp, angular grains. These sharply angular grains undoubtedly resulted from the fracture of larger grains during crushing operations.

SPECIFIC TESTS AND RESULTS

Test A - Acid Leaching

Two 200-g samples of the "as received" sand, which analysed 0.04% Fe_2O_3, were leached as per conditions outlined in Table 1. Leaching was conducted over 2-, 3-, 4-, 5- and 6-h periods. The iron content of sample 1 was reduced to 0.02% Fe_2O_3, and of number 3, to 0.015% Fe_2O_3 (average). The results with the 2-h leach were comparable to those of the longer leach periods. Two 3750-g samples were the leached, the first was slurried with 3.35 L of 35 v/v H_2SO_4 and the second with 2.8 L of acid from the first leach plus 1.055 L of fresh, 35 v/v H_2SO_4. The product from the first batch analysed 0.020% Fe_2O_3, and from the second 0.017% Fe_2O_3. Weight loss was 0.5%, and the moisture content of the filtered product, 7.2%. The products from the latter two leaches were combined and forwarded to Dr. Marleau on February 7, 1983.

Table 1 - Conditions of preliminary leach tests

	Test	
	1	2
Charge (g)	200	200
Acid volume (mL)	200	200
H_2SO_4 concn (v/v)	20	35
Retention (h)	6	6
Temperature (°C)	50	70
Displace. wash (mL)	2 x 100	2 x 100

Test B - Heavy Mineral Separation, Mineralogy and Chemical Analysis

Heavy liquid separation tests were conducted on the +60 mesh portions of samples 1, 2 and 3 using a liquid of density 2.96. Results were as follows -

Sample No.	Weight (g)	Sink Product	
		Weight (g)	Weight (%)
1	400	0.100	0.025
2	400	0.098	0.024
3	299	0.055	0.014

A stereomicroscopic examination of the sink products showed those from No. 1 and 2 to be similar but with different proportions of minerals. The sink portion of No. 3 was distinctly different. The minerals in each, identified by X-ray diffraction analyses, were as follows -

Samples 1 and 2 - quartz, mica (brown and colourless) gehlenite - akermanite, corundum, magnetite, chromite, tourmaline

Sample 3 - quartz, mica, tourmaline, garnet.

The sink products were not analysed chemically because of the extremely small quantities and the difficulty of measuring the elements requested.

Test C - Fusion Point and LOI

Small portions of samples 1, 2 and 3 were wetted with a small quantity of water and formed into 3 mm cubes. These were then placed in the furnace chamber of a Leitz Heating Microscope. The silhouette image was observed as the temperature was raised to fusion. The melting temperature was recorded as that point at which the silhouette image became hemispherical in shape. Fusion points were as follows -

Sample No.	Fusion Point, °C
1	1700
2	1700
3	1715

The LOI was not determined because of the small quantity of sample used.

Test D - Foundry Sand

Sample 4 was submitted to the foundry laboratory for evaluation as foundry sand. Dr. E.I. Szabo, who conducted this study, reported as follows -

> "These samples are a bit of a disappointment from the foundryman's point of view. The rounded particles - so desirable for foundry use - are found in the coarser, +28 mesh fraction only. The finer fractions show increasingly larger amounts of subangular and acicular grains. The sharp character of the sand places a greater demand on the quantity of binder required for a given level of strength, as well as results in poorer packing".

Thus the samples, as prepared and received, are unsuitable for use as foundry sand.